Oral cancer statistics in India on the basis of first report of 29 population-based cancer registries

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Abstract

Objectives: To summarize and provide an overview of age-specific oral cancer incidence reported in 29 population-based cancer registry in India.

Materials and Methods: Secondary data on age-adjusted rates (AARs) of incidence of oral cancer and other associated sites for all ages (0–75 years) were collected from the report of the National Cancer Registry Programme 2012–2014 in 29 population-based control registries.

Results: Among both males and females, mouth cancer had maximum Age adjusted incidence rates (64.8) in the central zone, while oropharynx cancer had minimum AAR (0) in all regions.

Conclusion: Oral cancer incidence increases with age with typical pattern of cancer of associated sites of oral cavity seen in the northeast region.

Keywords: Age-adjusted rates, cancer statistics, population-based cancer registry

INTRODUCTION

Cancer statistics are available from various cancer registries globally. A cancer registry is an organization for systematic collection, storage, analysis interpretation and reporting of data on subjects with cancer. There are two main types of cancer registry: population-based cancer registries (PBCRs) and hospital-based cancer registries. PBCRs seek to collect data (history, diagnosis, treatment and status) on all new cases of cancer occurring in a well-defined population.[1] This information gives us a knowledge of the burden of cancer, etiology studies and the effectiveness of the activities that have been undertaken to control cancer.

Oral cancer is major public health problem in the Indian subcontinent, where it ranks among the top three types of cancer in the country.[2] The difference in incidence and partner of oral cancer can be due to an overall effect of ageing of population as well as some regional differences in the prevalence of specific risk factor.[3] The low-income groups in India are affected most due to a wide exposure to risk factors such as tobacco chewing and insufficient

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exposure to newly diagnostic aids, resulting in a delay in reporting of oral cancer.[4,5]

The oral cavity includes the lips, buccal mucosa, teeth, gingiva, anterior two-third of tongue, floor of the mouth and hard palate.[6] Oral cancer is defined as the cancer of lips, mouth and tongue. This case definition is adopted and confirms to definition of oral cavity cancers by International Classification of Diseases (ICD) coding scheme, World Health Organization case definition and International Agency for Research and Cancer.[7] Since there are wide variations in pathologies of intraoral tumors, all cancers related to oral cavity and other associated sites such as cancers of lip, tongue, mouth, tonsils, salivary gland and oropharynx have been included from 29 PCBRs in India (2012–2014).

There are very few studies reporting incidence of oral cancer and other associated sites from cancer registries in India.[8-10] An updated overview of age-specific incidence data of all cancers of oral cavity and other associated sites will be of help for researchers and clinicians for quick reference of facts in cancer control. Information related to trends of oral cancer incidence forms the scientific basis for prevention, diagnosis and treatment of oral cancer in a community.[11] Time- and age-specific trends may also give rise to various hypotheses concerning the etiology of cancer which can be applicable for testing of various hypotheses in clinical and experimental oncology. This article attempts to provide the readers an updated overview of oral cancer incidence of six major sites across the country on the basis of 2012–2014 report from National Cancer Registry Programme (NCRP) for the years 2006–2011 that covered 29 PCBRs in India.

MATERIALS AND METHODS

The data for the present study are obtained from the published consolidated report of 29 PBCRs (2012–2014) NCRP of Indian Council of Medical Research (ICMR).[12] This is available for public use in NICPR-ICMR website. PBCRs are the only source which provides authentic data on the incidence and mortality of cancer in India for a defined period. The coverage is <10% of the population of India. The PBCRs in various parts across the country were divided into seven regions for the purpose of the present study which are as follows:
- North**:** Delhi, Patiala
- South: Bangalore, Chennai, Kollam, Thiruvananthapuram
- Central: Bhopal
- East: Kolkata

- Northeast: Cachar district, Kamrup urban, Manipur, Mizoram, Nagaland, Meghalaya, Sikkim and Tripura
- West: Mumbai, Nagpur, Pune, Ahemedabad and Barshi extended
- Rural west: Barshi (rural) and Ahemedabad (rural).

Cancer incidence refers to new cases diagnosed in a given population in a specified period of time. According to ICD-9 codes, data were collected from all sides related to oral cavity. These sites along with their codes were C_{00} (Lip), C_{01-02} (Tongue), C_{03-06} (Mouth), C_{07} (Tonsil), C_{09} (Salivary Gland) and C_{10} (OroPharynx).[12]

Data indicators such as age-adjusted rates (AARs) of oral cancer incidence up to age 75 and above of both the sexes in each of the 29 registries were obtained from NCRP source and were presented region-wise in the form of ranges.

RESULTS

The AARs for all cancers of oral cavity and other associated sites in 0–75 years of age are presented region-wise (north, south, west, east, northeast, central and rural west) in Tables 1-4. Figures 1-4 present the peculiar trends seen region-wise for oral cancer and all other cancers of associated sites around the oral cavity.

For all regions, the incidence of oral cancer for males and females was highest in the central region of India. For males, it was 64.8% and for females it was 37.2% at 70 years of age. The next highest magnitude was observed in west and northeast regions (58.4%) at 60 years of age.

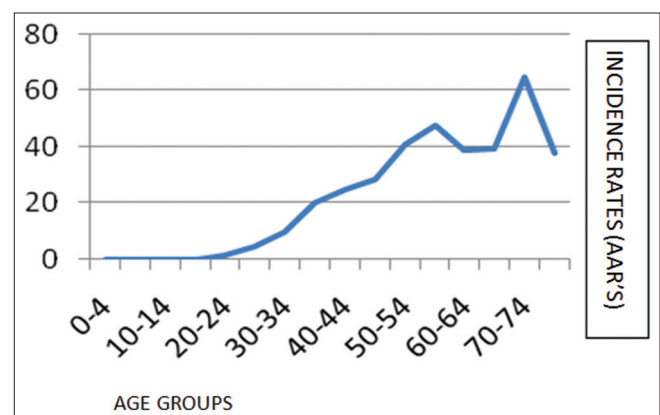The overall trend of oral cancer has been found with wide ranging values for both males and females.

Figure 1: AAR mouth cancer in the central region (Bhopal population-based cancer registry) in males

Table 1: Highest and lowest age-specific incidence rates of oral cancer in all regions in males (29 population-based cancer registries)

Region		0-9 Maximum	0-9 Minimum	10-19 Maximum	10-19 Minimum	20-29 Maximum	20-29 Minimum	30-39 Maximum	30-39 Minimum	40-49 Maximum	40-49 Minimum	50-59 Maximum	50-59 Minimum	60-69 Maximum	60-69 Minimum	70-75+ Maximum	70-75+ Minimum
North	Lip	0.1	0	0.1	0	0.1	0	0.3	0	1	0.7	2.1	1.5	5.6	4.4	5.1	0.6
	Tongue	0.4	0	0.1	0	1.7	0	7.4	0	14	0	26.8	0	58.4	0	40	7.3
	Mouth	0	0	0.2	0	0.4	0	8.2	3.85	15.6	9.5	28.5	17.8	41	28.1	39	9.55
South	Lip	0	0	0	0	0	0	0.2	0	1.2	0	1.2	0	1.1	0	1	0
	Tongue	0	0	0.3	0	2.27	0	8.6	0.3	15.3	1.7	22.7	9.4	34.3	15	32.1	16.1
	Mouth	0	0	0	0	2	0	8.1	0	20.9	4.2	15.4	10.9	36.5	17.2	52.3	36.6
Northeast	Lip	0	0	0	0	0	0	0	0	0	0	2.3	0	0	0	37.1	0
	Tongue	0	0	0.2	0	0.4	0	2.2	0	7.1	0	21.7	0	33.2	0	37.8	0
	Mouth	0.5	0	0.5	0	1.6	0	28.6		38.3	0	56.2	0	58.4	0	45.1	0
West	Lip	0	0	0	0	0.4	0	1.3	0	2	0	3.0	0	8.7	0	12.3	0
	Tongue	0.5	0	0.5	0	2.9	0	12.7	0	17	0	16.2	0.3	33.2	1.5	16.8	0.9
	Mouth	0.5	0	0.5	0	7	0	28.6	0	42.1	0	56.2	0	58.4	0	45.1	0
Central	Lip	0	0	0	0	0	0	0.2	0	0.7	0	1	0.7	0.9	0.4	1	0
	Tongue	9	9	0	0	3	0.9	9.5	7.8	16.8	16	23.8	22.4	26.5	26.4	30.7	28.3
	Mouth	0	0	0	0	4.5	1.8	20.2	10.1	28.6	24.2	47.9	40.9	39.6	38.9	64.8	37.8
East	Lip	0	0	0	0	0.5	0	0.5	0.5	0.5	0	1.7	0	3	1	1.6	0
	Tongue	0	0	0	0	3.4	0	6.2	3.6	8.5	8.1	13.2	10.8	23.9	20.9	22.8	20.2
	Mouth	0.8	0	0	0	1	0	4.6	4.1	15.1	11.2	23.8	19.9	26.9	22.9	20.9	18.6
Rural	Lip	0	0	0	0	0	0	0	0	0	0	0	0	4.4	0		
	Tongue	0	0	0	0	0	0	2.0	1.9	7.7	2.1	5.9	0	14.4	3.7	26.1	4.4
	Mouth	0	0	0	0	1.5	0	6.0	5.8	7.7	4.2	15.5	11.9	29.9	25.1	17.4	0
All regions	Lip	0.1	0	0.1	0	0.4	0	1.3	0	2	0	3.1	0	8.7	0	37.1	0
	Tongue	0.5	0	0.5	0	3	0	12.7	0	17	0	26.8	0	58.4	0	37.8	0
	Mouth	0.5	0	0.5	0	7	0	28.6	0	42.1	0	56.2	0	58.4	0	64.8	0

Age groups

Table 2: Highest and lowest age-specific incidence rates of oral cancer (associated sites) in all regions in males (29 population-based cancer registries)

Regions	0-9		10-19		20-29		30-39		40-49		50-59		60-69		70-75+	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
North																
Tonsil	0.1	0	0	0	0.3	0	0.4	0	5.1	1	6.4	2.9	12.3	7.2	11.3	0
Oropharynx	0	0	0	0	0.2	0	0.6	0	1.6	0	6.2	0	8.3	0	4.7	0
Salivary gland	0	0	0.1	0	0.6	0	1.7	0	1	0	3.2	1.4	5.6	1.9	8.2	0
South																
Tonsil	0	0	0	0	0	0	0.7	0	0.9	0	5	0	4.7	1.6	10.3	2.5
Oropharynx	0	0	0	0	0.6	0	0.9	0	4.3	0	11.9	0	13.8	1.6	10.3	2.8
Salivary gland	0	0	0	0	0.9	0	1.6	0	0.9	0.3	2.3	0	4.7	1.6	5.5	0
Northeast																
Tonsil	0	0	0	0	0.8	0	5.3	0	19.7	0.55	30.3	3.3	36.3	9.5	28.2	3.15
Oropharynx	0	0	0	0	0	0	2.4	0	8.5	0.2	10.7	1.9	27.2	2.5	9.4	0.9
Salivary gland	4.7	0	1.6	0	5.1	0	3.2	0	1.9	0	7.8	0	8.4	0	12.9	0
West																
Tonsil	0	0	0	0	0.4	0	0.7	0.2	2.3	0.9	7.9	0.9	13.9	1.4	15.4	3.9
Oropharynx	0	0	0	0	0.1	0	0.7	0	0.8	0	6.2	0	8.3	0	6.3	0
Salivary gland	0	0	0.5	0	0.6	0	2.1	0	2	0	8.5	0	5.9	0	5.3	0
Central																
Tonsil	0	0	0	0	0	0	0.6	0	0.7	0	2.5	2.3	9.6	3.5	5.3	3.4
Oropharynx	0	0	0	0	0	0	0.7	0	1.7	0.7	2.3	1.6	5.3	3.5	6.8	6.3
Salivary gland	0	0	0	0	0	0	0.7	0	1.7	0.7	1.6	1.1	1.8	0	3.4	0
East																
Tonsil	0	0	0	0	0.5	0	0	0	1.2	0.5	1.2	1.7	4	3	5.7	1.6
Oropharynx	0	0	0	0	0	0	0	0	1.1	0	0.8	0.7	2	1.5	1.9	1.6
Salivary gland	0	0	0	0	0	0	0	0	0.6	0	1.7	1.3	4.5	4.0	4.7	3.8
Rural																
Tonsil	0	0	0	0	0	0	2.0	0	0	0	0	0	3.6	0	0	0
Oropharynx	0	0	0	0	0	0		0	0	0	0	0	0	0	4.4	0
Salivary gland	0	0	0	0	0	0	0	0	0	0	3.9	0	0	0	4.4	0
All regions																
Tonsil	0.1	0	0	0	0.8	0	5.3	0	19.7	0	30.3	0	36.9	0	28.2	0
Oropharynx	0	0	0	0	0.6	0	2.4	0	8.5	0.2	11.9	0	8.3	0	10.3	0
Salivary gland	0	0	1.6	0	5.1	0	3.2	0	2	0	8.5	0	8.4	0	12.9	0

Table 3: Highest and lowest age-specific incidence rates of oral cancer in all regions in females (29 population-based cancer registries)

Region	Age groups															
	0-9		10-19		20-29		30-39		40-49		50-59		60-69		70-75+	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
North																
Lip	0	0	0	0	0	0	0	0	0.8	0	1.3	0.7	3.5	0	3.7	0
Tongue	0	0	0.1	0	1	0	1.6	0	7.6	1.5	10.8	1.9	15.4	2.5	9.2	2.4
Mouth	0	0	0	0	11	0	1.9	0	4.2	0	10	1.9	13.9	4.1	13.3	2.7
South																
Lip	0	0	0	0	0	0	0.2	0	0.3	0	1.2	0	1.1	0	0.9	0
Tongue	0	0	0.3	0	0.5	0	1.7	0.4	3.7	2.05	7.7	3.6	18.5	8	16.9	11.4
Mouth	0.3	0	0.3	0	0.3	0	0.5	0	4.7	1	16.7	4.5	25.7	0	42.2	17.6
Northeast																
Lip	0	0	0	0	0	0	1.4	0	2	0	3.5	0	10.9	0	14	0
Tongue	0	0	0.2	0	1.2	0	3.5	0	6.2	2.6	13.9	4.9	17.9	8.9	14.6	7.7
Mouth	0	0	0.6	0	1.2	0	9.9	0	20.0	0	18.9	0	43.6	0	60.2	0
West																
Lip	0	0	0	0	0.4	0.2	0.9	0.2	1.5	1	1.6	1.4	4.4	2.6	3.7	2
Tongue	0	0	0.2	0	1.2	0	3.5	0.7	6.2	2.6	13.9	4.9	17.9	8.9	14.6	7.7
Mouth	0	0	0.6	0	1.2	0.5	9.9	1.2	9.4	4.9	14.9	9.1	27.9	11.5	28.5	15.1
Central																
Lip	0	0	0	0	0	0	0.2	0	0.7	0.3	1	0.7	0.9	0.4	1	0
Tongue	0	0	0	0	0.5	0	2.7	1	9.6	1.3	14.1	6.6	18	12.7	11.2	2.7
Mouth	0	0	0	0	0.5	0	1.9	0.7	10.6	7.2	15.8	10.6	29.4	21.6	37.2	29.6
East																
Lip	0	0	0	0	0.5	0	0.5	0	0.6	0	1	0.8	1.1	0	2.1	1.5
Tongue	0	0	0	0	0	0	0	0	0.6	0	0	0	0	0	6.3	0
Mouth	0	0	0	0	0	0	0	0	1.8	0.7	0.8	0	3.3	1.1	2.1	0
Rural																
Lip	0	0	0	0	0	0	0	0	2.2	0	0	0.8	6.7	0	0	0
Tongue	0	0	0	0	0	0	2.0	0	5.4	2.2	3.8	0	6.7	3.1	4.6	0
Mouth	0	0	0	0	0	0	0	0	2.7	2.2	7.7	3.2	6.7	3.1	9.7	0
All regions																
Lip	0	0	0	0	1.2	0	1.4	0	2	0	14.9	0	27.9	0	28.5	0
Tongue	0	0	0.3	0	1.2	0	3.5	0	9.6	0	14.1	0	18.5	0	16.9	0
Mouth	0	0	0	0	11	0	9.9	0	20	0	18.9	0	43.6	0	60.2	0

Table 4: Highest and lowest age-specific incidence rates of oral cancer (associated sites) in all regions in females (29 population-based cancer registries)

| Region		0-9		10-19		20-29		30-39		40-49		50-59		60-69		70-75+	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
North																	
	Tonsil	0	0	0	0	0.1	0	0.3	0	0.7	0	1.2	0	2.9	0	2	0.3
	Oropharynx	0	0	0	0	0	0	0.5	0	0.2	0	0.8	0	0.7	0	1	0
	Salivary gland	0	0	0	0	0.7	0	0.5	0	1.8	0.5	1.6	0	0.8	0	2	0.3
South																	
	Tonsil	0	0	0	0	0.2	0	0.6	0	0.4	0	3.2	0	2.4	0	2.7	0
	Oropharynx	0	0	0	0	0	0	0	0	0.3	0	1	0	2.6	0	3.3	0
	Salivary gland	0.8	0	0.8	0	1.9	0	1.5	0	1.5	0	2.2	0.4	3.6	0.5	1.9	0.6
Northeast																	
	Tonsil	0.4	0	0.2	0	0.4	0	1.2	0	4.4	0	6.6	0.2	5.5	0	10.9	0
	Oropharynx	0	0	0	0	0	0	0	0	0.9	0	0.8	0	9.5	0	7.4	0
	Salivary gland	0	0	1.3	0	1	0	1.6	0	2	0	10.3	0	2.6	0	14	0
West																	
	Tonsil	0	0	0	0	0.6	0	1.4	0	1.9	0	2.2	0	7.7	0	7.7	0
	Oropharynx	0	0	0	0	0.4	0	0.6	0	0.7	0	2.8	0.9	1.8	1.6	3	2
	Salivary gland	0.2	0	0.6	0	0.5	0	1.3	0	1.7	0	1.4	0	3.3	0	3.1	0
Central																	
	Tonsil	0	0	0	0	0.6	0	1.4	0	4.4	0	6.6	0	7.7	0	10.9	0
	Oropharynx	0	0	0	0	0	0	0	0	1.7	0	1.8	0	0	0	0	0
	Salivary gland	0	0	0	0	0	0	0.7	0.8	0.8	0	2.7	0	2.7	0	0	0
East																	
	Tonsil	0	0	0	0	0.5	0	0.5	0	0.6	0	1	0.8	1.1	0	2.1	1.5
	Oropharynx	0	0	0	0	0	0	0	0	0.6	0	0	0	0	0	6.3	0
	Salivary gland	0	0	0	0	0	0	0	0	1.8	0.7	0.8	0	3.3	1.1	2.1	0
Rural																	
	Tonsil	0	0	0	0	0	0	0	0	0	0	0	0	6.7	0	0	0
	Oropharynx	0	0	0	0	0	0	0	0	0	0	0.7	0	0	0	6.3	0
	Salivary gland	0	0	0	0	0	0	0	0	0	0	0	0	3.1	0	0	0
All regions																	
	Tonsil	0	0	0	0	0.6	0	1.4	0	4.4	0	6.6	0	7.7	0	10.9	0
	Oropharynx	0	0	0	0	0.4	0	0.6	0	1.7	0	2.8	0	9.5	0	7.4	0
	Salivary gland	0	0	0.8	0	1.9	0	1.6	0	2	0	0	0	3.6	0	1.4	0
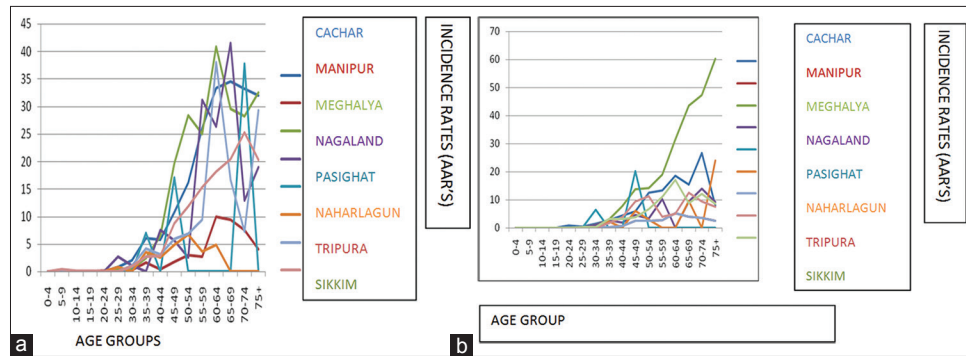
Figure 2: (a) AAR mouth cancer in the northeast region population-based cancer registries in males. (b) AAR mouth cancer in the northeast region population-based cancer registries in females
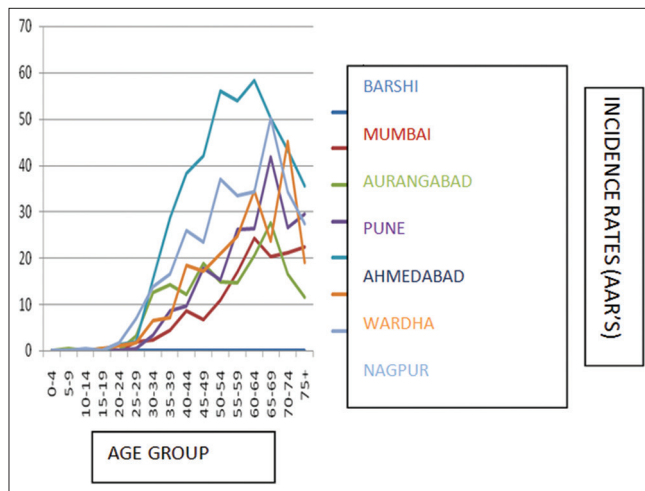

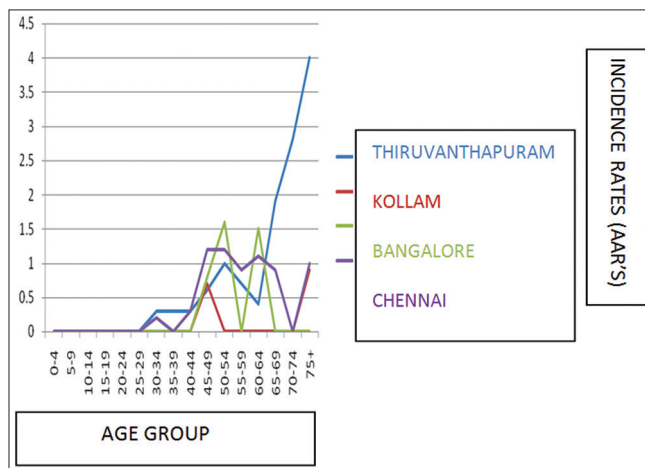**Figure 3:** AAR mouth cancer in the west region (BARSHI population-based cancer registry) in males

Figure 4: AAR lip cancer in the south region (Thiruvananthapuram population-based cancer registry) in males

Mouth cancer

AAR mouth cancer was maximum in the central region among males (64.8%) in the 70- to 75-year age group followed by AAR in northeast and west regions of India (58.4%) in 60- to 69-year age group [Table 1]. Among

females, development of mouth cancer was maximum in the northeast and central regions with AARs of 60.2% and 37.2%, respectively, in the 70- to 75-year age group [Table 3].

Figure 1 showed AAR (mouth cancer) for Bhopal PBCR (central region) in males. The pattern showed a gradual increasing trend in AAR at 20 years of age with two sharp peaks at 60 years and 70 years.

Figure 2a and b showed an overlapping pattern of AAR (mouth cancer) in northeast regions. In males, both Nagaland and Meghalaya PBCRs showed increasing peaks, whereas in females only Nagaland PBCR showed a gradual increasing peak

Figure 3 observed a very typical wide distribution pattern in Barshi PBCR (west region) in males.

Tongue cancer

North region was at the highest risk of developing tongue cancer (58.4%) in the 60- to 69-year age group among males followed by northeast regions (37.2%) in the 70- to 75-year age group [Table 1]. Females showed a different pattern with maximum AAR in the south region (18.5%) followed by the north region (15.4%) in the 60-year age group [Table 3].

Lip cancer

Highest AAR (37.1%) was observed among males in the northeast region in the 70-year age group followed by AAR (12.3%) in west regions in 70- to 75-year age group. Females showed maximum AAR in the northeast regions followed by the north regions (37%) in the 70- to 75-year age group [Tables 1 and 3].

Figure 4 showed AAR (lip cancer) in the south region. Thiruvananthapuram PBCR represented a very sharp peak at 70 years.

Figure 5a and b showed AAR (lip cancer) among males and females in northeast regions (Pasighat and Nagaland)
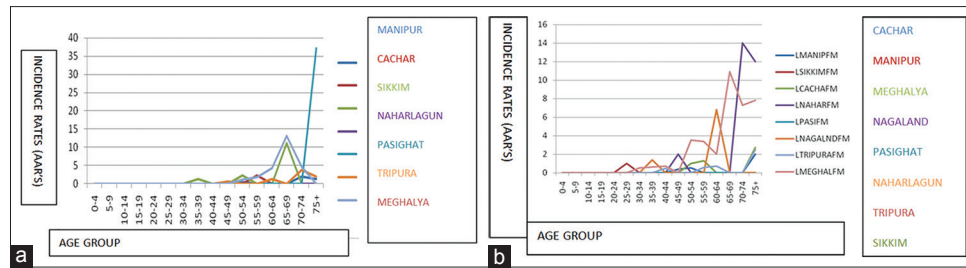
Figure 5: (a and b) AAR lip cancer in the northeast region (Pasighat and Naharlgun population-based cancer registry) in males and females

PBCRs. Figure 5a observed a very sudden sharp peak of Pasighat PBCR at 70 years in males. Figure 5b showed a very sharp sudden peak of Naharlgun PBCR among females at 65 years.

Cancers of associated sites (tonsils, salivary gland, oropharynx) around oral cavity

Males observed maximum AAR (tonsil cancer) (36.3%), while females showed maximum AAR (salivary gland) (14%).

DISCUSSION

The present article depicts the first report of NCRP based on the data of 29 PBCRs. The NCRP report does not include data according to different regions of the country but rather registry-wise. The reason for this was probably the limited number of registries in the vast country. Though NCRP report covers various parts of country, they do not sufficiently represent various regions. Despite this drawback, we have presented the data of 29 registries region-wise (north, south, central, west, east, northeast and rural west).

A compiled summary of such updated recent, detailed statistics on all cancers of oral cavity and other associated sites would serve as a ready reference for researchers and clinicians who are interested in knowing about the oral cancer load in the country.

The overall risk of developing oral cancer among males was highest in the central zone followed by western, northeast and southern zones, while among females, the highest incidence was observed in the northeast zone followed by central zone.

Risk factors

The present article revealed the maximum incidence for mouth cancer in central region. This highest incidence of mouth cancer in central region in India can be attributed due to many etiological factors. The most important among them is the use of tobacco. The Global Adult Tobacco Survey (GATS) conducted in India in 2009–2010 reported the highest prevalence of use of areca nut-based tobacco products among males in Madhya Pradesh followed by

Gujarat, Maharashtra and Delhi.[13] According to GATS, tobacco use in India has been higher among males than females. Though, among middle-aged and elderly males and females, the pattern of use of chewing tobacco was the same. Tobacco use was found to be more common among the uneducated masses in India. This can often be related to less knowledge and awareness among the uneducated people regarding the health hazards of tobacco use. Poverty was also significantly associated with higher risk of use of chewing tobacco. Thus, it indicates that there is a relationship between these socioeconomic indicators and tobacco consumption, thereby leading to increased oral cancer incidence. In India, the nonawareness of health hazards of tobacco is strongly associated with its use. The severity of health risks associated with tobacco use is sometimes so much inadequately understood by tobacco users that there is a need to spread comprehensive information about the health hazards of tobacco use among every subsection of the society.[14]

Many studies have shown the association between the use of tobacco and high oral cancer incidence.[13,15,16] Mehta *et al.* reported the reduced incidence of oral cancer among those who stopped or reduced tobacco use in rural population.[13]

Age-specific trends

Oral cavity cancers were traditionally being thought of as a disease mainly affecting people of older age group. In the present article, the pattern observed is different. The cases are observed at a very early age of life. This increased incidence of oral cancer at a very young age group has been usually attributed to indiscriminate usage of substances, mainly tobacco and tobacco-related products, over a prolonged period of time, which leads to genetic damage. Immune surveillance reduces at age 20 and above. This reduced immunity conjugating with indiscriminate usage of toxious substances justifies (AAR) oral cancer incidence at a very early age in life.[17] This finding of AAR of all types of oral cancer incidence at a very early age holds true for our article as well.

AAR oral cancer shows increasing incidence with age. Out of all the types of oral cancers, AAR (mouth and tongue) cancers among males show cases at a very early age group of

0–20 years specially in the western region PBCRs followed by the north region PBCRs. Among (AAR) other cancers of associated sites around oral cavity, tonsil cancer shows cases at a very early period in life (0–9 years) in the north region PBCRs. Our article justifies that the magnitude of cancers of childhood is apparently increasing in India. The differences in proportion and severity of childhood cancer incidence among different regions in India could be due to geographical and gender variations, exposure during prenatal development as well as compliance to cancer registration. In low- and middle-income developing countries, children who are diagnosed (80%) with cancer each year have poor access to curative treatment and only about 20% survive.[18-20] The differences in cancer survival between high- and low-income countries continue to increase as curative therapies are much more developed in high-income countries.

The second highest incidence of mouth cancer was observed among females in the northeast region. The northeast region is becoming the hub of cancer incidence and deaths. Northeastern states of India are showing a very peculiar type of cancer incidence pattern compared to mainland India. This may be due to genetic factors, lifestyle, food habits and other factors associated with it. A study reported that the overall risk of developing tobacco-related cancer was highest in the northeastern region compared to all other regions. The study also compared northeastern cancer incidence data with global data and found its similarities with the southeastern Asian region. Thus, genomic pool of northeastern region of India is different from rest of the country but resembles with the southeastern Asian region.[21]

Limitations

The present article divided 29 PBCRs into different regions that were arbitrary in nature for the sake of ease in presentation. This kind of presentation may not cover the entire population of that region due to diverse distribution in coverage of limited population of PBCRs in that particular region. Though these registries cover various parts of our country, they do not efficiently represent various regions which are far distant from the center of location of PBCRs.

CONCLUSION

The study observed a general increase in oral cancer incidence especially in the central region. Females showed a considerable high peak in oral cancer incidence in the northeastern states. More number of cancer registries should be established across country for more adequate representation of all regions of India.

Conflicts of interest
There are no conflicts of interest.

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